The VERSEAU - TRACKSED Project: origin of Loire River basin sediments

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Introduction: In France, since the beginning of 20th century, rural landscapes have been completely modified by human activities. These practices have resulted in profound sedimentary and morphological alterations (channel bed incision, deposition of fine sediment, bank erosion, etc.), detrimental to the achievement of good water status [1].
Several research efforts have already investigated either global budgets at the river basin or continental scale or local detailed budget at the plot to the field scale. However, very few studies have tried to analyse the connectivity between fluxes and storages and to draw the links between the different scales. In this broad context, the purpose of this study is to examine source-to-sink dynamic of the sediment cycle for the Loire River Basin. This project is broken down into two steps: the first step's aim is to understand poorly studied processes such as sediment production by agricultural drainage or bank erosion by catchment monitoring. The second step is to elaborate a distributed model of sediment connectivity from hillslopes to basin outlet.

Methods:.for the first step, two catchment sites are studied, using historical data or monitoring: the linear (21 km) of two small streams ("La Ligoire") and the Louroux lake catchment. Most of those two catchments are intensively cultivated and have been extensively submitted to subsurface drainage using drain tiles. The objectives of this part are threefold: 1) quantify incision and deposition processes since the channelization of the streams (1970), (2) quantify in-channel deposition rates of fine sediments, and, (3) explain the spatial distribution of these deposits.
For the second step, the modeling approach is based on the use of indicators to describe hillslope processes, potential downstream retention, attempting to link river basin characteristics to a prediction of sediment exports in rivers. It provides insight in the identification of the most influent sediment redistribution processes on the total sediment fluxes and on the differences between various basin typologies [2] [3].

Results and discussion: The Ligoire study shows an important stream incision (around 30 cm in 40 years) and the influence of water obstacles on sediment distribution. The Louroux monitoring should allow a better understanding of the origin and dynamics of sediment transport within small intensively cultivated plain catchments.
The first results from the second step on mean annual suspended sediment loads, show that catchments contribute from 4.8×10^2 to $3.7.10^5$ $t.yr^{-1}$ to the overall Loire river sediment exports (which equals 8.6×10^6 $t.yr^{-1}$) and area-specific suspended sediment yields have been calculated (Fig.1). Investigations on catchments global characteristics should then allow the identification of dominant processes on sediment redistribution and help to draw local then regional distributed sediment budgets to bridge the gap between the different spatial scales. Contribution of hillslopes to the overall catchment budget should finally help to assess in-stream contributions and redistribution processes.

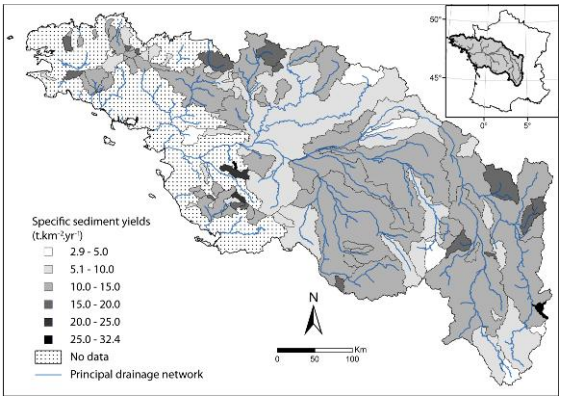

Fig. 1: Specific sediment yields in the Loire River Basin.

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